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**IDAHO NATIONAL ENGINEERING AND
ENVIRONMENTAL LABORATORY**

ADVANCED MIXED WASTE TREATMENT PROJECT

WMF-602 FIRE HAZARDS ANALYSIS

BNFL INC.

2/23/05

Prepared for:

**U.S. Department of Energy
Idaho Operations Office
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BNFL Inc.

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ACRONYMS

AHJ	authority having jurisdiction
AHU	air handling unit
AMWTP	Advanced Mixed Waste Treatment Project
ANL-W	Argonne National Laboratory – West
BNFL	British Nuclear Fuels Inc.
CAM	continuous air monitor
CH	contact handled
DOE-ID	U.S. Department of Energy, Idaho Operations Office
DSA	Documented Safety Analysis
EMS	emergency medical services
FD	fire department
FHA	Fire Hazards Analysis
FRP	fiberglass reinforced plywood
HCB	hollow concrete block
HVAC	heating, venting, and air conditioning
HWMA	Hazardous Waste Management Act
INEEL	Idaho National Engineering and Environmental Laboratory
INL	Idaho National Laboratory
LEL	lower explosive limit
MCFL	maximum credible fire loss
MIP	multiplexer interface panel
MPFL	maximum possible fire loss
NFPA	National Fire Protection Association
PIV	post indicator valve
R	risk
RCRA	Resource Conservation and Recovery Act
RTR	real-time radiography
RWMC	Radioactive Waste Management Complex
SWEPP	Stored Waste Examination Pilot Plant
TAN	Test Area North
TRU	Transuranic
TRUPACT	Transuranic Package Transporter
TSA	Transuranic Storage Area
UBC	Uniform Building Code



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UFC	Uniform Fire Code
UPS	uninterruptible power supply
WMF	Waste Management Facility



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1.0 INTRODUCTION

This is the Fire Hazards Analysis (FHA) for Waste Management Facility WMF-602 at the Advanced Mixed Waste Treatment Project (AMWTP) at the Idaho National Laboratory (INL). The FHA contains a complete assessment of the risks from fire and fire-related hazards in the building.

1.1 Methodology

This FHA was performed in accordance with DOE 420.1, Facility Safety. The approach taken in evaluating the fire-related perils in WMF-602 was to identify fire hazards that concern the life safety of personnel, property damage, environmental damage, and mission impact and evaluating the effectiveness of in-place mitigation in relation to acceptable fire risk levels. The information presented is based on facility authorization basis documentation, construction specifications and drawings, operating procedures, and building inspections.

1.2 Limitations

This FHA has been prepared based upon the current conditions of WMF-602 such as occupancy, arrangement, and fire hazards. It includes an evaluation of such things as equipment, chemicals, flammable and combustible materials, and hazards present. If any changes occur in occupancy, arrangement, equipment (new equipment brought in or old equipment removed), the amount or type of hazardous waste in the facilities, this FHA must be reviewed by a qualified fire protection engineer and revised to reflect these changes.

Previous FHA documentation was absorbed as part of this analysis and this analysis does contain statements concerning fire systems and general building construction that were accepted as accurate from the previous FHA.

1.3 Occupancy and Facility Use

The facility was activated in 1974 and, according to RWMC documentation, falls under the 1973 UBC. It is a single-story building measuring 74'-8" by 32'. The entire area (2,389-ft²) is a high bay with a 20-ft ceiling. The building is classified an F-1 (moderate hazard factory and industrial) occupancy per the UBC and an Industrial Occupancy per NFPA 101.

The building provides covered "garage" space for cask transport vehicles that are loaded with TRUPACT casks ready for shipment.

Transuranic Package Transporter (TRUPACT) containers, on truck beds waiting shipping, are present in WMF-602



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2.0 CONSTRUCTION

2.1 Construction Description

The WMF-602 is a 2,389-ft² single-story, prefabricated, steel-frame building classified as Type II-N construction by the UBC. Two personnel doors are located on the east end of the building and one on the west end.

The building contains a large open or highbay area with vehicle access through overhead doors on both ends. Vehicles are garaged in the building including the cask transport vehicle. The building is approved for garaging light industrial transport vehicles, snow blowers, and other fossil-fueled vehicles.

The building is a single fire area with no fire rated barriers.

2.1.1 Heating, Venting, and Air Conditioning (HVAC)

The building is heated with two electrical resistance heaters (HV-EHTR-0202 and -0203) that are controlled with wall thermostats (HV-TH-0202 and -0203). There is no forced ventilation or other air conditioning in the building.

2.1.3 Electrical

The electrical and lighting system connections are shown on Drawings No. 177152 and 446740. Electrical power can be shutoff to the building at main disconnect switch N-PP-0201.



3.0 LIFE SAFETY

3.1 Means of Egress

WMF-602 is classified as Industrial Occupancy per NFPA 101. The building is provided with three (3) exits that discharge directly to grade. One (1) exit is located on the west wall of the building and two (2) exits are located on the east wall. The exits are adequately spaced and marked.

3.2 Emergency Lighting and Exit Signs

Illuminated exit signs and emergency lighting is provided for both facilities in accordance with NFPA 101.

3.3 Security Interface

There is no security system in the building.

4.0 FIRE HAZARDS

4.1 Identification and Analysis of Significant Fire Hazards

As there is no storage of hazardous materials in WMF-602, the fire hazards present result from the structure itself and from the fuel fired equipment staged or stored in the building.

On occasion, prior to shipment, trucks loaded with full TRUPACT containers will be staged in the building. The hazardous material inside the containers is not considered “at risk” as the container provides adequate protection from fire.

Fuel associated with equipment stored or staged in WMF-602 is the largest risk to the facility. A ruptured fuel line can cause a pool of fuel on the floor of the building. Hot surfaces of the vehicle engine and exhaust system are a credible ignition source for the fuel. A resulting fire presents an exposure severe enough to impact the facility.

Faults in the buildings electrical system can provide an ignition source for a fire. However, due to the buildings Type II-N construction and the lack of combustible loading normally in the building, the effects of an electrical fire are expected to be minimal. There is a wood framed partition covered with sheetrock that is used to close off a room on the North-side of the building.

4.2 Natural Hazards Impact on Fire Safety

WMF-602 is designed in accordance with UBC requirements for high wind and snow loads typical of the INL environment. Occurrences of a natural hazard such as an earthquake or tornado could result in structural damage to the buildings, possibly causing electrical fires. Tornado events are highly unlikely on the INL. Earthquakes are a fairly common occurrence in southeast Idaho, however no significant seismic activity has been identified beneath the INL. The wet sprinkler system within WMF-602 is designed with earthquake bracing for the Seismic Zone 2B, per the UBC.

WMF-602 is not provided with a dedicated lightning protection system. This is a steel building with electrically continuous roof assemblies, located in the vicinity of substantially taller structures. An NFPA 780 Appendix H risk assessment reveals a moderate risk (R) of 2.8 for WMF-602, assuming structures housing the manufacture, handling, or storage of hazardous materials.

A lightning strike is expected to impact one of the taller, lightning protected buildings in the TSA. No sidestroke effects are anticipated for WMF-602, because of adequately designed lightning protection systems for adjacent buildings.

While lightning protection is not required per the NFPA Standards or the UBC, a lightning strike is a potential fire initiator for facilities not equipped with lightning protection systems.



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The dominant natural fire hazard on the INL is wild land fires. There are approximately 572,000 acres of rangeland within the INL. Man-caused or lightning-initiated range fires on or near INL boundaries are a common occurrence. The hazard is effectively mitigated by the use of non-combustible building materials, a well defensible perimeter road around the facilities, a defoliated zone around the structures, and an emergency response organization trained and equipped to combat wildland fire. WMF-602 is not considered at risk to range fire.

4.3 Exposure Fire Potential

WMF-602 is considered a single fire area. Any fire in the building is expected to affect the entire building.

Potential exterior exposures include WMF-601, located approximately 75-ft. east and WMF-645, 646, and 657, located approximately 100-ft. west of the building. All exterior exposure buildings are composed of noncombustible construction and are fully sprinkled. These mitigating factors minimize the exposure concern.

4.4 Chemical and Radiological Hazards

No chemical hazards are expected to exist in WMF-602.

No radiological hazards are expected to exist in WMF-602 above the top layer of concrete flooring. There is a question regarding whether contaminated material exists beneath the new concrete floor that was poured in 1994. Repeated attempts have failed to produce any reliable documentation to confirm or deny the amount of potentially contaminated material left behind and/or the extent of decontamination activities, which may have occurred. There is no radioactive release concern from a fire in WMF-602 as long as the top layer of concrete flooring remains intact, since any potential contamination that may still exist is in the layer below.

5.0 FIRE PROTECTION

5.1 Water Supply and Distribution System

The water supply for WMF-602 is supplied through the RWMC. This supply system consists of WMF-639, Firewater Pumphouse and WMF-727, a 250,000-gal water storage suction tank. Two 2,000-gpm at 125-psi fire pumps, one electrically powered and the other driven by a diesel engine, provide the primary and backup required fire flows for the facility. Normal system pressure is maintained at approximately 150 psi by the domestic water pumps in WMF-603, Potable Water Pump-house. WMF-603 also houses the deep-well pumps that fill both the potable water tank and the firewater storage tank.

The electric fire pump is a Peerless, Model 8AEF20, 1780-rpm, single stage, split case, horizontal, centrifugal pump. The impeller size is 17.7-in. Maximum brake horsepower (BHP) is 197.6. Churn pressure is 142.5-psi. A 200-hp Lincoln, Model TV-5386 motor, drives the pump. It is a 3-phase 460-V motor. The electric fire pump controller is a Metron Model M430-200-460C with an internal mercury switch. The controller is set to start the pump upon system pressure of 120-psi. The pump controller is provided with a minimum run timer set at approximately 11-minutes. Power to the pump motor is supplied in accordance with the requirements of NFPA 20, *Installation of Stationary Pumps for Fire Protection*.

The diesel fire pump is a Fairbanks-Morse, Model 28CF, 1750-rpm, single stage, split case, horizontal, centrifugal pump. The impeller size is 17.25-in. Maximum BHP is 218.9. Churn pressure is 140.3-psi. The pump is driven by a 255-hp Cummins Model NT-855-F1 diesel engine. The diesel fire pump controller is a Metron Model FD2-AFJPSV with an internal mercury switch. The pump is set to start with a system pressure of 110-psi. It has a start delay of approximately 24-seconds. The pump will start automatically upon loss of commercial power. The pump must be manually shut off once it has started. The pump controller has standard diesel engine supervision functions, per NFPA 20. A 300-gal tank provides fuel for the driver. A low fuel level alarm is set at 70% (210-gal) full. The INL M&O is responsible for maintaining the levels of the fuel tank.

An FM Global approved 500-gal bladder tank is installed in building WMF-639 to provide water hammer shock protection for the equipment in the pump house and absorb pressure surges to the fire water distribution system when the fire pumps come on line.

The water level in water tank WMF-727 is maintained manually between 21 and 25 ft. (207,413 gal and 246,921 gal). Water is supplied to the tank by the domestic water pumps in WMF-603 that pull water from the 250,000-gal domestic water tank (WMF-709). A backflow prevention device is installed in the 10-in. cross connection between the two systems. The tank level is monitored electronically and manually during normal working days and filled when the level approaches 21-ft. A low tank level alarm is reported when the level drops to 20-ft. The tank is insulated and provided with a circulation pump and heater to maintain water temperature above freezing during cold conditions. A low tank water temperature alarm is transmitted when the water temperature drops to 40-°F.



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5.2 Fire Suppression Systems

WMF-602 is equipped with a full coverage, wet pipe sprinkler system designed to meet the requirements of NFPA 13 for an Ordinary Hazard pipe schedule system. The sprinkler system design criterion is consistent with NFPA 13 requirements for the configuration of hazards in the building.

A 4-in. underground main is routed along the north side of the building. There are two dry barrel fire hydrants within 300 ft of the building. The existing configuration provides the required fire flow for manual suppression demands associated with WMF-602. A PIV provides exterior isolation capability for the fire suppression system. Calculations done in EDF-RWMC-596 indicate that 1,500 gpm at 44.1 psi is available at the most remote sprinkler head. This is adequate for the Ordinary Hazard pipe schedule system plus hose stream allowance. A maximum building water demand requirement of 1,500 gpm at 20-psi has been established for WMF-602 for a 90-min. duration.

5.3 Fire Detection and Alarm Systems

WMF-602 is equipped with a local fire alarm system that is connected to the INL Proprietary Fire Alarm System. The building fire alarm control panel is a FireQuest 200. This panel functions as the local panel. The reporting panel is the Thorn KDR1000 multiplexer interface panel (MIP) No. 2, located in WMF-601, and reports alarms to the INL Alarm Center. The PIV for WMF-602 reports directly to MIP #2 and does not go through the Firequest 200 panel. Signals are transmitted over copper wire to the RWMC dial room in WMF-619 where they are interfaced with the site-wide fiber optic telephone transmission network and sent to the alarm center.

Initiating devices in WMF-602 consist of manual pull stations at all exits and a water flow alarm. The building is provided with audible/visible alarm notification devices that satisfy the local notification requirements of NFPA 72 and NFPA 101.

The WMF-602 fire alarm system is connected to the standby power system as well as provided with batteries capable of maintaining the system for 24 hrs. The system is provided with required supervisory and trouble condition monitoring, including control valve tamper, loss of AC power, and loss of communications. All alarms signals report to the INL Alarm Center. Emergency response is initiated upon receipt of any initiating device. Upon receipt of a supervisory or trouble alarm, the INL Alarm Room operator notifies the BNFL Shift Supervisor or on-call emergency coordinator for initiation of investigation and corrective actions.

Notification appliances for the fire alarm system are independent of the area wide Emergency Notification System (ENS). The WMF-602 ENS is connected to the BBWI ENS instead of the BNFL ENS.

5.4 Operational or Maintenance Factors Affecting Fire Protection

BNFL Inc. has a comprehensive fire protection program in place that implements the requirements of DOE Order 420.1, Facility Safety. BNFL Inc. maintains a qualified fire protection engineer and a fire protection technician, on staff, to implement and monitor the effectiveness of the program.

The program requires that all fire protection systems and equipment be inspected, tested, and maintained. Maintenance work orders are in place for inspection, testing, and maintenance of fire protection systems. The fire protection systems are maintained operable to the extent possible. Any impairment associated



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with the systems are reviewed by qualified fire protection personnel and approved upon implementation of necessary compensatory measures. A qualified fire protection engineer, prior to approval, reviews all facility modifications and operating procedures with fire protection concerns.

5.5 Fire Department Operations

The INL Fire Department (FD) provides fire suppression, emergency medical services (EMS), hazardous materials incident response, and technical rescue services for WMF-602. The fire department operates three fire stations. Fire Station No. 1 is located at the CFA, approximately five miles from the facilities. Fire Station No. 2 is located at Argonne National Laboratory – West (ANL-W), approximately 25 miles from the facilities. Fire Station No. 3 is located at Test Area North (TAN), approximately 20 miles from the facilities.

The FD typically operates with 28 firefighters and two battalion chiefs per shift. The critical minimum staffing level requires 20 firefighters and one battalion chief per shift. Five staff officers are also available to respond during day shifts. The normal response to WMF-602 will be one engine/ladder company (consisting of five firefighters), one ambulance, and the duty battalion chief with a rescue vehicle.

The INL FD is a paid full time, fully trained department with adequate staffing. In addition to the fire suppression, EMS, hazardous materials response, and technical rescue, the FD also conducts on-site inspections concentrating primarily on familiarization with the larger facilities, due to their complexity. The FD maintains pre-fire plans for the major operation areas including WMF-602.

The INL FD has mutual aid agreements with Idaho Falls, Blackfoot, Arco, Rexburg, American Falls, Chubbuck, Jefferson County, Pocatello, Rigby, ANL-W, the Bureau of Land Management (BLM), and the National Park Service.

Upon receipt of a fire alarm from WMF-602, the FD will generally respond to either the AMWTP or RWMC main gate based on information received from the on scene command. The FD contacts security forces and facility management, as necessary, for access to alternate, normally locked gates on the perimeter fence. AMWTP and RWMC personnel will assist the FD regarding incident location. The response time from Fire Station No. 1 to WMF-602 is typically 10 to 15 minutes.

INL FD equipment includes pumper trucks, ambulances, a hazardous materials unit, a rescue vehicle, wildland fire units, a water tender, 4X4 pickup trucks, and miscellaneous support vehicles (air supply trailer, rehab trailer, generator trailer and fire chief/command vehicle).



6.0 FACILITY EQUIPMENT AND PROGRAM PRESERVATION

6.1 Protection of Essential Safety Class Systems

There are no safety class systems located in WMF-602.

6.2 Identification, Description, and Protection of Vital Programs and Critical Process Equipment

No equipment in WMF-602 is identified as vital by DOE.

6.3 Identification and Protection of High Dollar Value Equipment

No equipment in WMF-602 is considered "high dollar value." Therefore, no redundant or specialized fire protection features are in place in the building.

6.4 Facility Damage Potential

It is assumed that neither the MCFL nor MPFL fire scenario presents an adequate exposure to result in the breach of the TRUPACT shipping cask that is periodically garaged in the building.

6.4.1 Maximum Credible Fire Loss (MCFL)

The MCFL for WMF-602 is a fire that originates from a fuel spill in the highbay area. The fire is expected to be controlled by not more than three (3) sprinkler heads, as the combustible loading within the facility is minor. Using 130-ft² as the coverage area for a single sprinkler head, the area subject to fire damage is 390-ft². The entire building will experience smoke damage. The estimated square footage multiplier for building damage is \$200/ft² over the fire area. This results in an MCFL of \$80,000.

6.4.2 Maximum Possible Fire Loss (MPFL)

Because WMF-602 is a single fire area, the MPFL is a fire that results in a total loss of the building. The replacement value for WMF-602 is \$525,212, which represents the MPFL value.

6.5 Emergency Planning

The emergency planning at WMF-602 is the same as that for the entire AMWTP. For specific information on emergency planning for these buildings, see the AMWTP Emergency Plan/RCRA Contingency Plan (MP-EP&C-12.1). The Emergency Plan/RCRA Contingency Plan for the AMWTP contains the implementing documents for emergency response for the AMWTP and is written to comply with requirements that are in addition to those of Hazardous Waste Management Act of 1983, as amended (HWMA)/RCRA. The INL base plan organization has been followed in this plan to provide integration of the AMWTP Emergency Plan/RCRA Contingency Plan with the existing INL emergency plans as well as with the DOE-ID Emergency Organization to ensure coordination of notification and response activities.



6.6 Security Coordination

Facilities are normally accessed through the RWMC main gate or the AMWTP main gate. If access is needed at another location, the FD will contact security as necessary to access other normally locked gates on the perimeter fence. Security or others will generally assist the FD by leading them to the incident location. The FD has keys to the locked gates if they need to use them. Security will not inhibit fire fighting/rescue personnel in any way.



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7.0 CONCLUSIONS

The overall assessment of the FHA for WMF-602 is that it meets the intent of the applicable codes, standards and DOE Orders.

Determination of no deficiencies was made at the time this FHA was written. This FHA should be re-evaluated annually, by a qualified fire protection engineer to capture any changes made to the facility and to determine if deficiencies have been created by the changes made.



8.0 RECOMMENDATIONS

(NONE)



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9.0 REFERENCES

Advanced Mixed Waste Treatment Project Documented Safety Analysis, BNFL-5323-RPT—ESH-02, Rev. 2, February 2004

DOE Order 420.1, Section 4.2, *Facility Safety*, U.S. Department of Energy, Washington, D.C., July 1999

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Radioactive Waste Management Complex Safety Analysis Report, INEEL-94/0226

RWMC Area Wide FHA/FSA, FHA-RWMC, Rev. 0, September 22, 2000

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RWMC Fire Water System, SDD-150, Rev. 0, August 5, 2003

Uniform Building Code

Uniform Fire Code

WMF-602 High Bay, SDD-165, Rev. 0, September 3, 2003



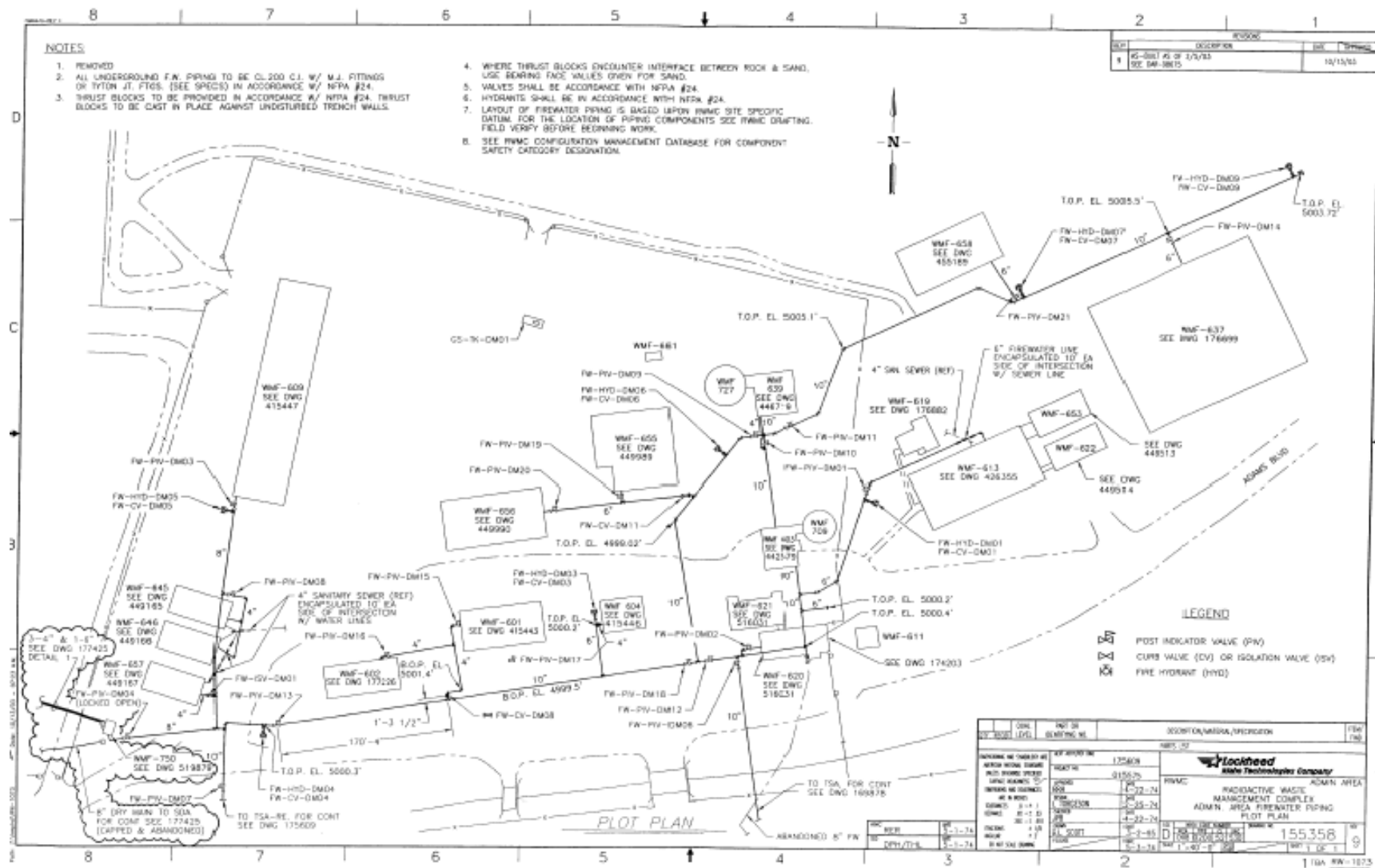
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APPENDIX A

DRAWINGS



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